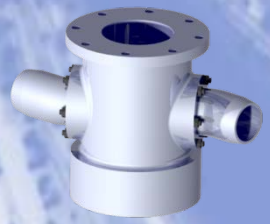
KHI Turbo Mixer

An efficient sludge recovery system & mixing or blending system for product tanks of all types:

- Tank cleaning & sludge recovery
- Crude Oil blending
- Lube Oil blending
- Clean Fuels blending
- Carbon Black Oil blending
- Asphalt circulation
- Chemical product Blending

Sludge Formation

Crude oil storage can be problematic due to the mixing of various crude types. This can lead to stratification of the different crude types, sludge formation on the bottom of the tank and excessive BS&W in the crude itself. Appropriate mixing of the crude is generally required to prevent these un-wanted conditions.



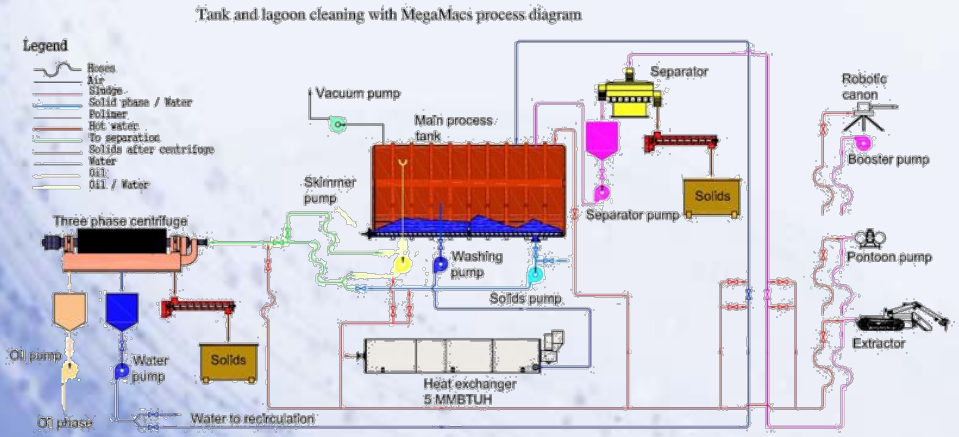
Historical Solutions

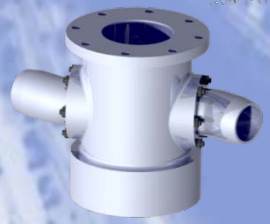
Historically mechanically driven propeller mixers were installed on the tank shells in an attempt to mitigate these problems. Tank cleanings over the last 30-40 years have demonstrated propeller mixers simply do not produce enough energy to keep crude types being inventoried today in suspension. This is especially so on the larger crude tanks in service today as evident by the large amounts of sludge found in the tanks when removed from service of cleaning & inspection.

Traditional Cleaning Methods Cont.

"The paraffin-based sludge that forms on the bottom of the tank is traditionally removed by: manual cleaning, robotic methods, chemical cleaning…"

-North American Mixing Forum

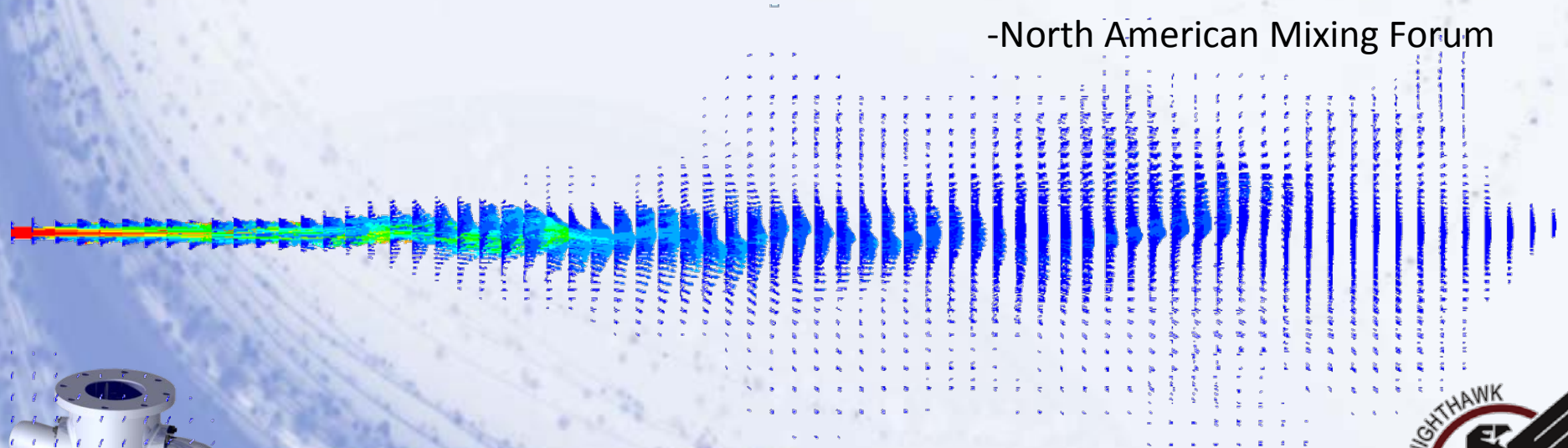


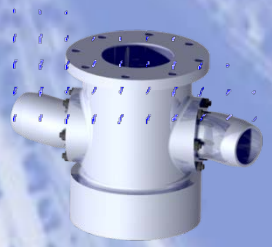


Energy / Velocity for Sludge Recovery

"The paraffin-based sludge… is mainly composed of long chain hydrocarbons held together via Van der Waals forces and behaves as a thixotropic non-Newtonian fluid. Thus, it is a shear thinning fluid. For a jet to suspend the deposited particles, the entering kinetic energy must overcome the Van der Waals forces. The energy required to prevent sludge formation in medium and heavy crudes is 0.6 to 0.8 hp/kbbl. It has been found that the critical velocity of typical crude oil required to maintain sheared sludge particles in suspension is approximately 0.6 to 1.2 m/s [17]."

-North American Mixing Forum





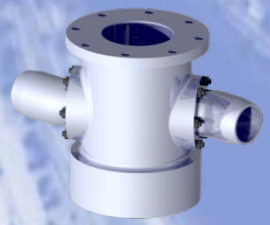
Proven Technology

Submerged Jet Mixing (SJM) technology has proven itself to provide enough energy to thoroughly mix/blend various crude types as well as shear existing sludges found on the bottom of tanks to the point of eliminating all three conditions listed above.

In addition to mixing crude tanks SJM is an excellent blending system for Crudes, Lube Oils, Clean Fuels, Carbon Black Oils, Asphalt blends, etc.

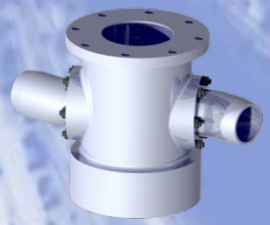
Why use KHI Turbo Mixer for **Temporary** Tank cleaning?

- Sludge is 95% recoverable hydrocarbons once re-suspended
- Significantly reduces Haz. Waste & associated disposal cost
- Significantly reduces personal exposure during cleaning operations
- Reduces/Eliminates safety hazards vs. open air tank cleaning
- Industry accepted non-intrusive tank cleaning method
- Significantly reduces tank T/A time and cost

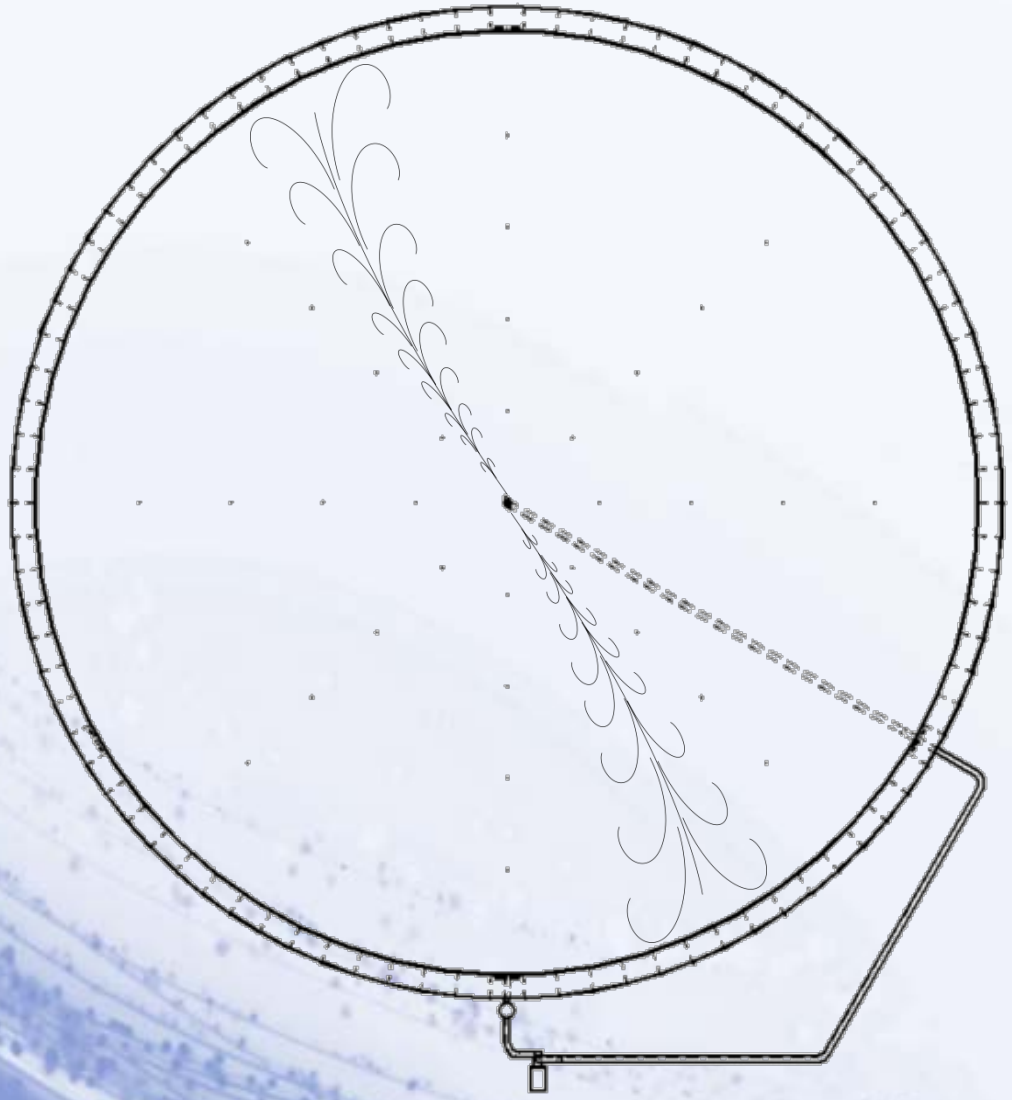


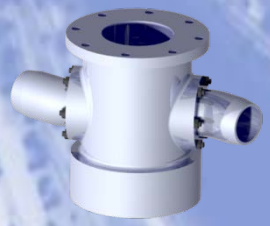
Why use KHI Turbo Mixer for **Permanent** Tank Mixing/Blending?

- Eliminates multiple mechanical propeller mixer maintenance
- Eliminates mechanical propeller mixer seal leaks/oil spills
- Reduces mixing / blend time
- Mitigates gravity stratifications
- Mitigates excessive BS&W build-up from sludge accumulation
- Extends tank continuous run length by eliminating product quality issues
- Reduces/Eliminates future expensive tank de-sludging /cleanings

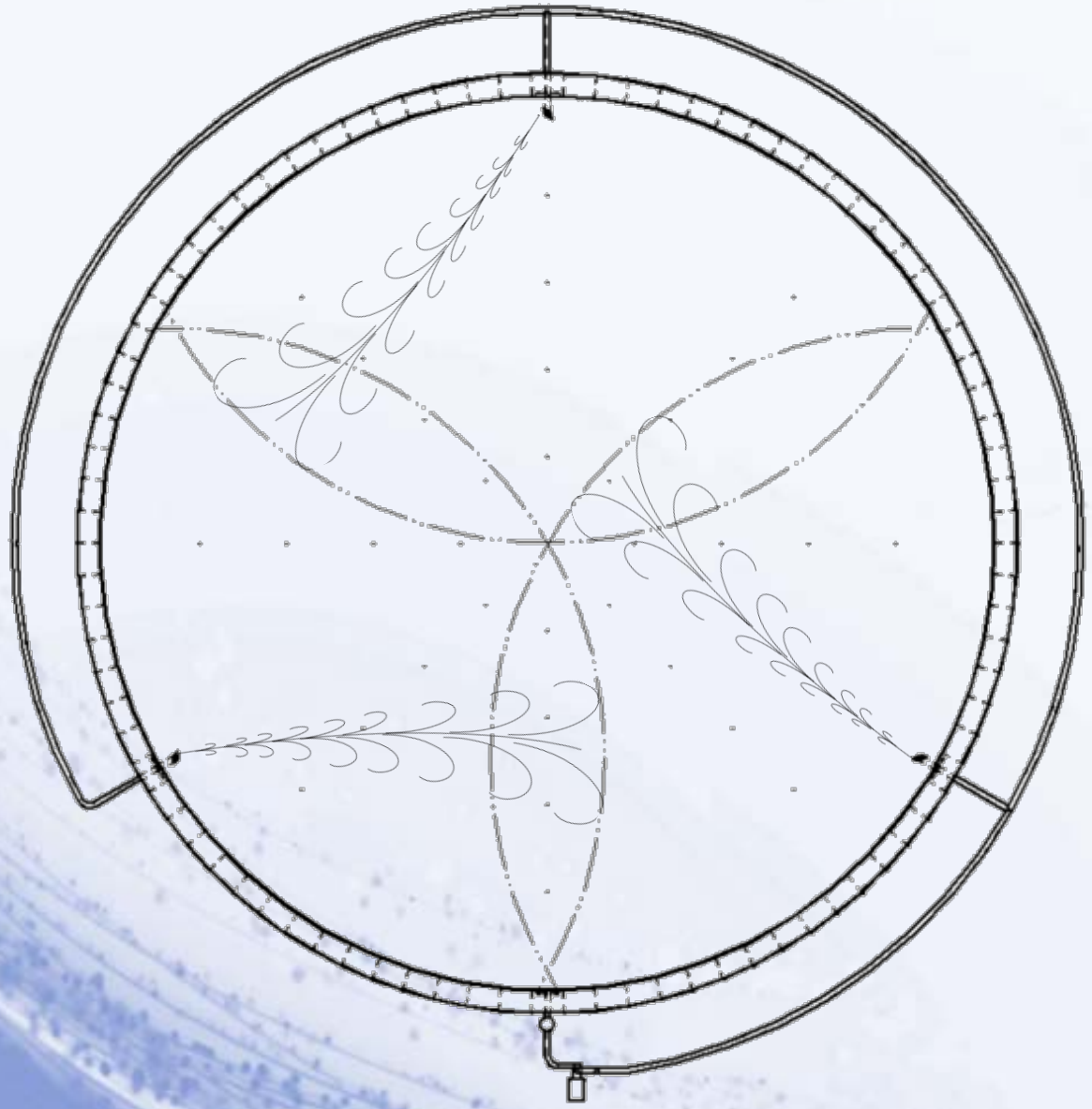


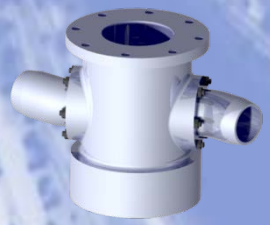
Center Mounted Flow Pattern (Permanent Installation)



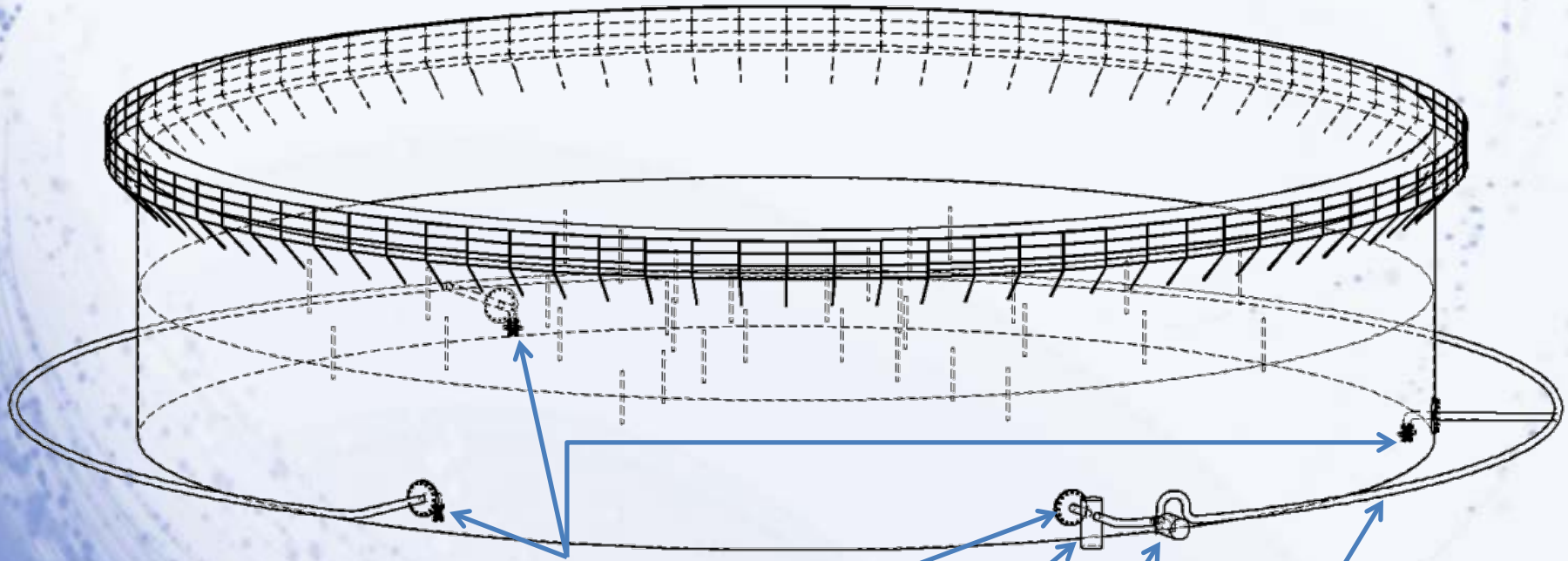


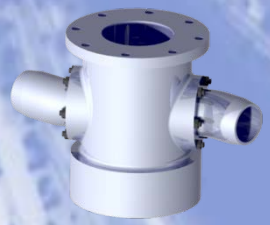
Shell Mounted Flow Pattern



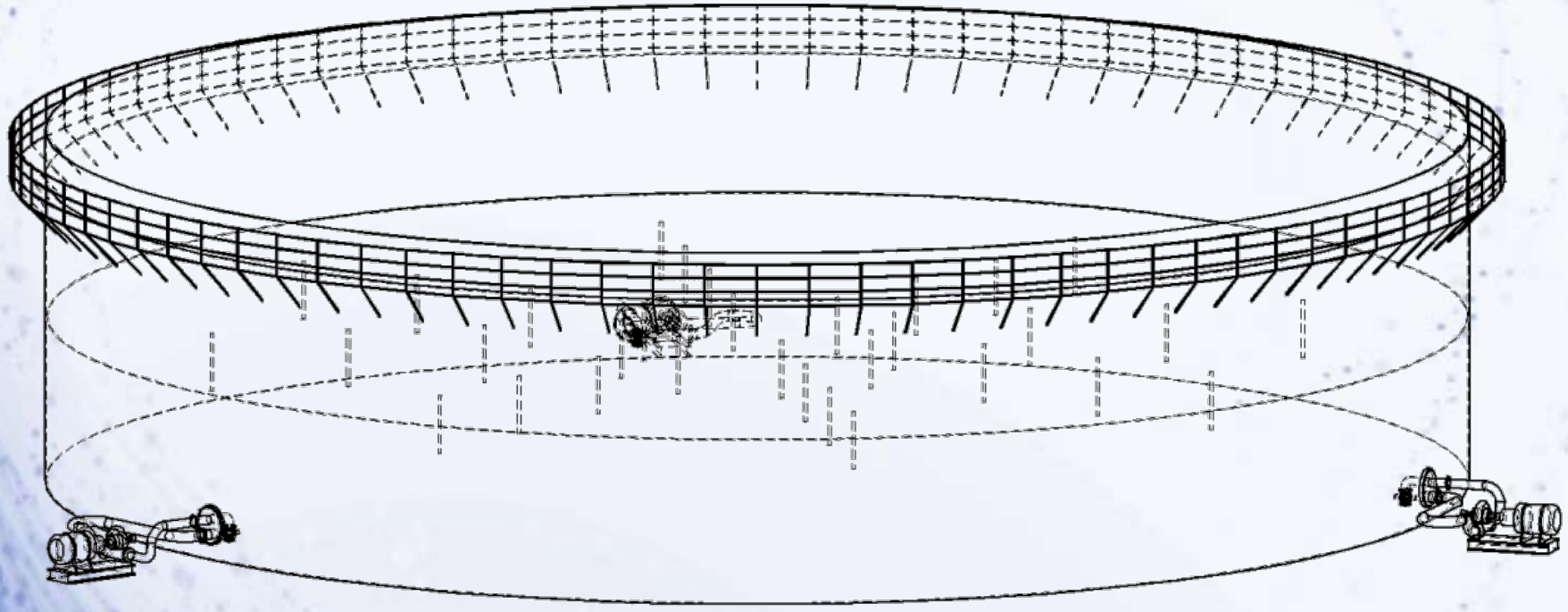


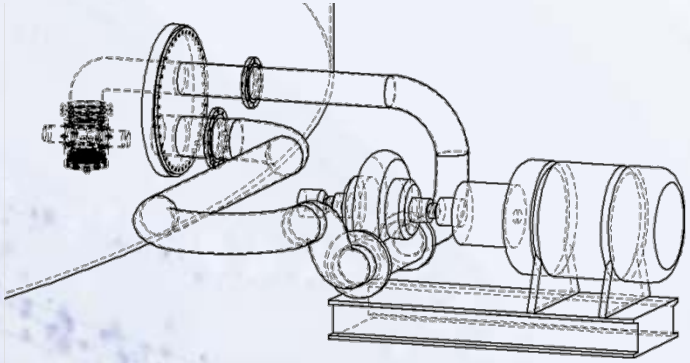
Shell Mounted Layout

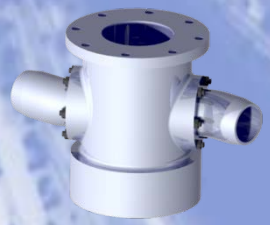




Shell Mounted Alt. Configuration







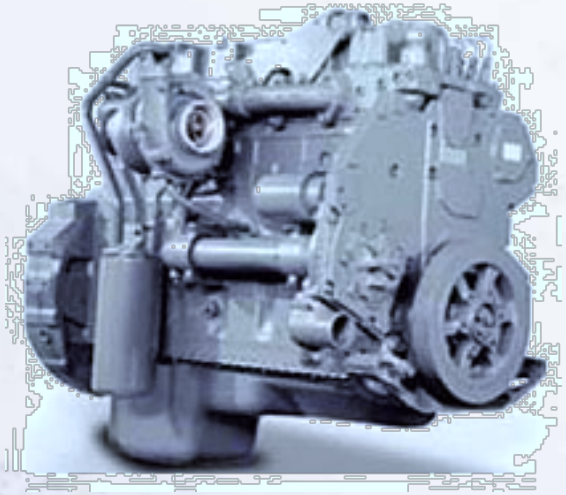
Ancillary Equipment

Centrifugal Pump

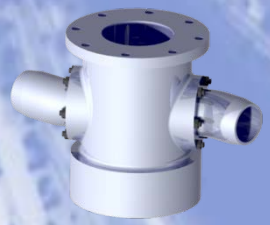
Electric Motor

Or

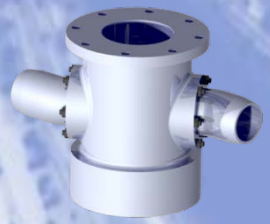
Diesel Motor



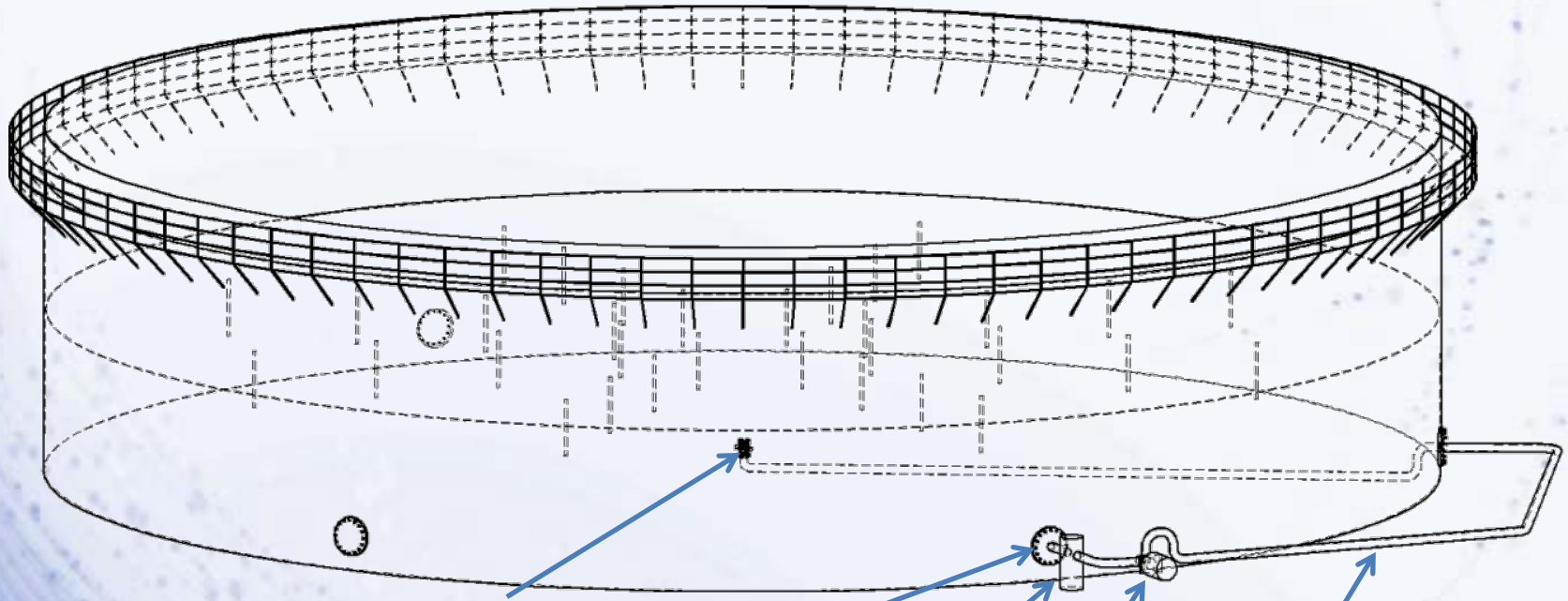
Basket Strainer

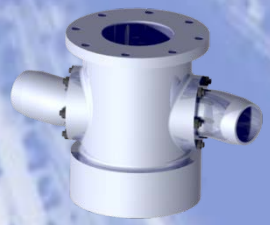


Pump Packages



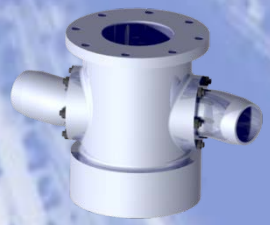
Center Mounted Layout



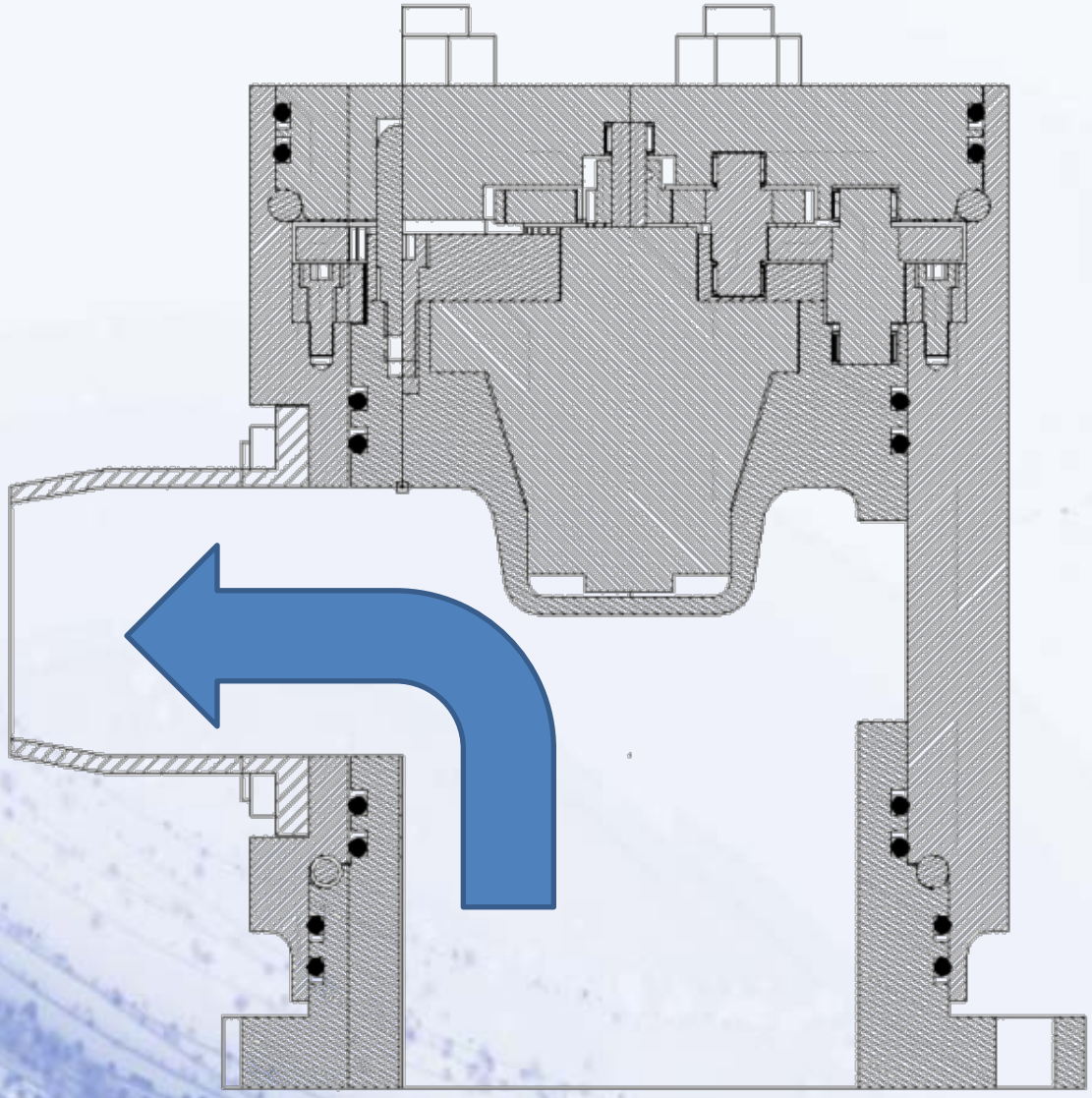


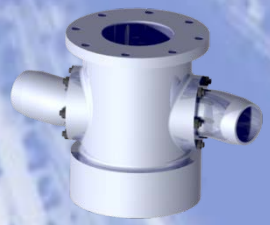
Advantages of KHI Turbo Mixer

- Reduces electricity usage vs. multiple mechanical propeller mixers
- Less moving parts than SJM competitors means longer service life
- Vector thrust drive system more efficient than SJM competitors
- Less frictional losses than SJM competitors (due to unrestricted flow path)= higher flow rates for given H/P usage
- No maintenance required for duration of tank run length
- Excellent method for heating tanks when utilized with exchanger & circulation system



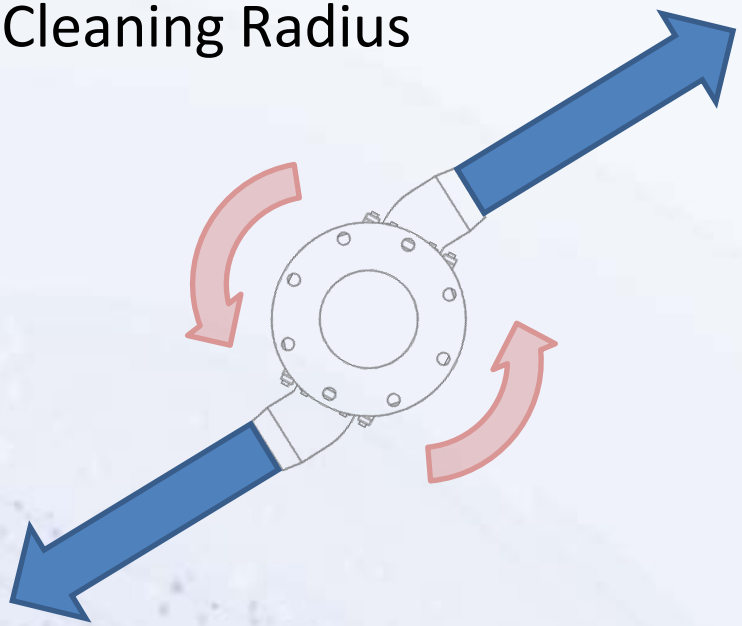
Unrestricted Flow Path

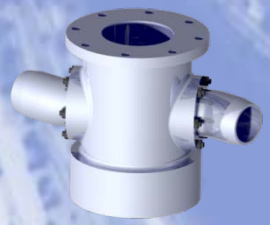




Vector Thrust Drive System

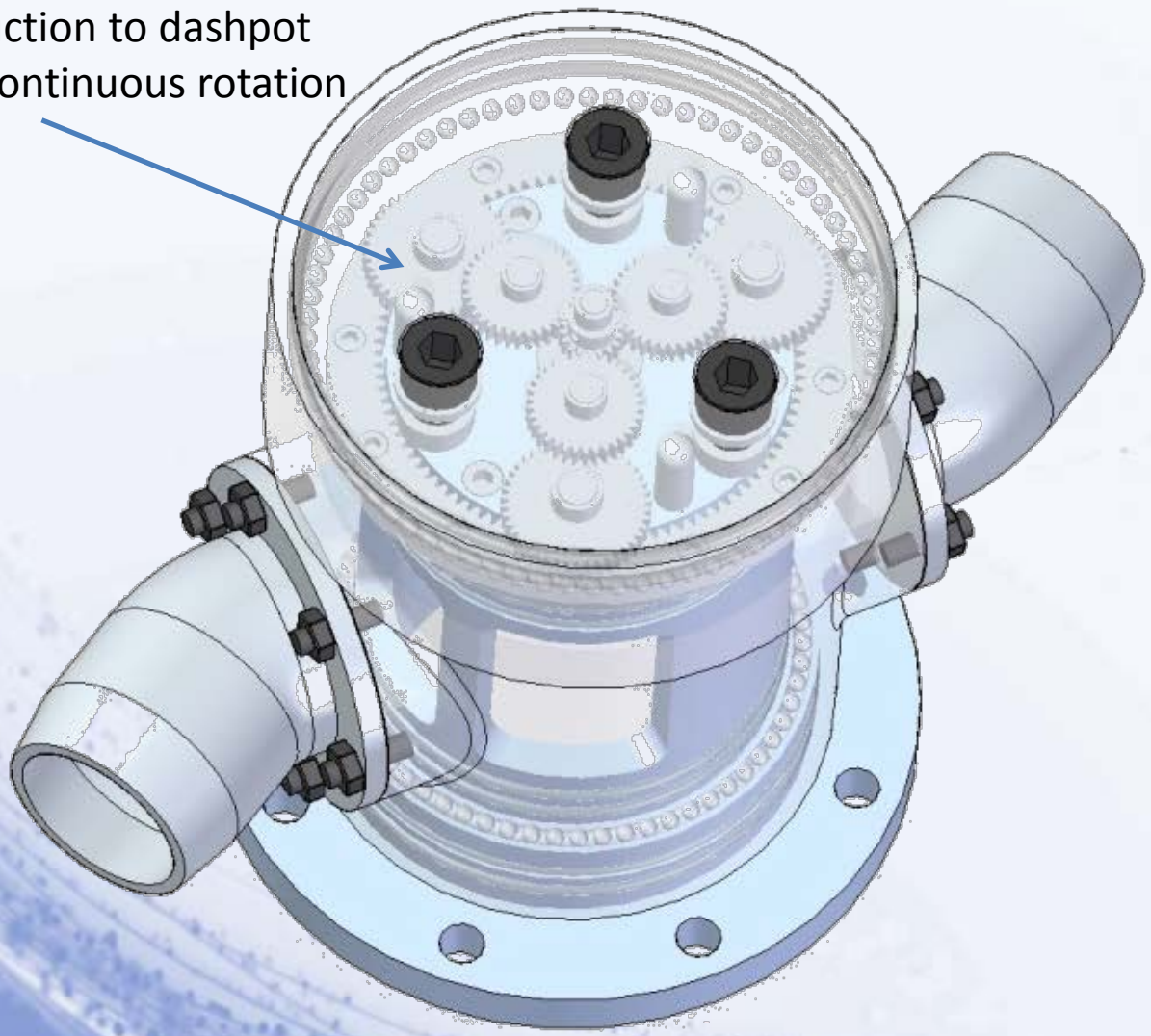
- Torque Generated By Offset Nozzles
- Internal Viscous Controls Prevent Over Speed
- Flow Field Customized by Replaceable Nozzles
- Up to 175’ Cleaning Radius

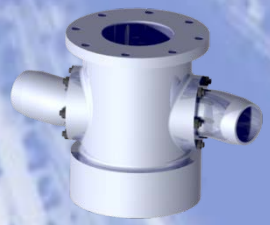




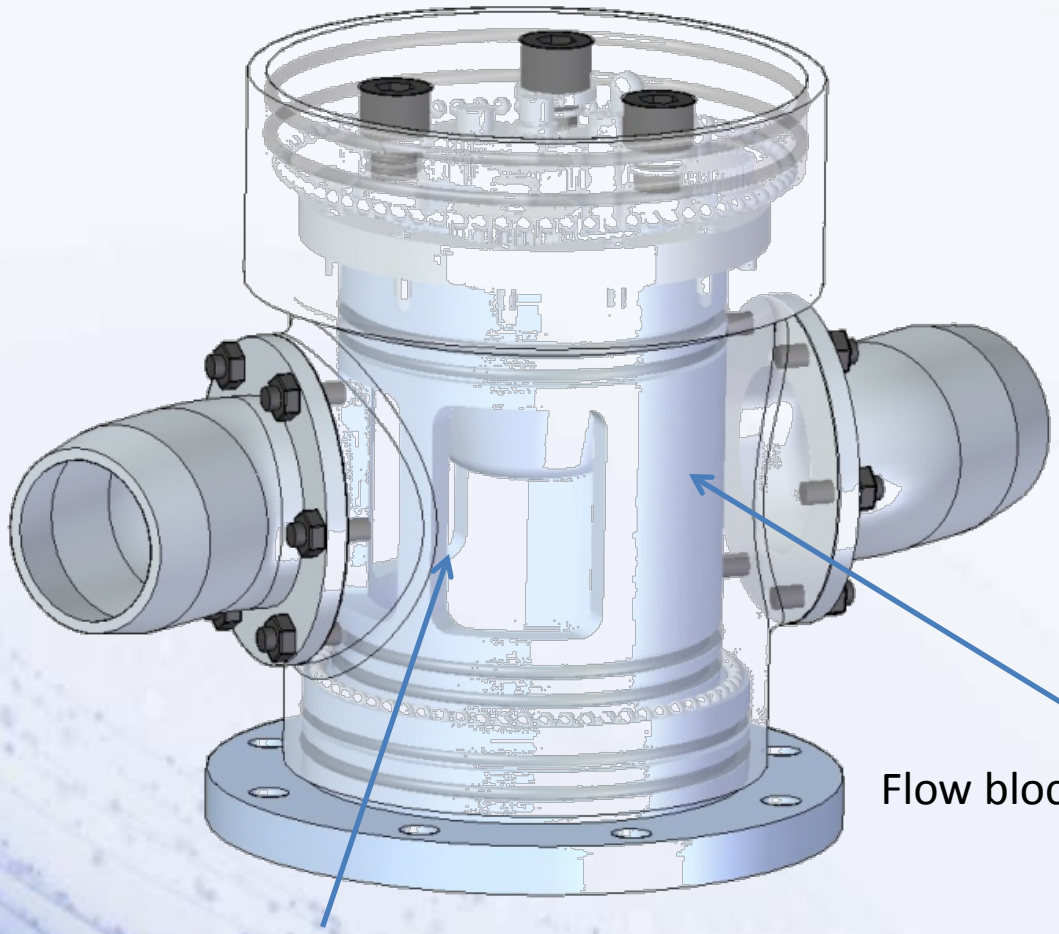
Turbo Mixer® Internals (Gear Drive)

40:1 gear reduction to dashpot
Creates slow continuous rotation





Turbo Mixer® Internals (Shell Mount)



Flow blocked on back side

Windows allow flow on one side only